

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

WEB BASED TRAINING FOR THE HELLENIC NAVY

by

Georgios Stavritis

September 2001

Thesis Advisor:
Second Reader:

Rudolph Darken
Chris Eagle

Approved for public release; distribution is unlimited

Report Documentation Page		
Report Date 30 Sep 2001	Report Type N/A	Dates Covered (from... to) -
Title and Subtitle based Training for the Hellenic Navy	Contract Number	
	Grant Number	
	Program Element Number	
Author(s) Stavritis Georgios	Project Number	
	Task Number	
	Work Unit Number	
Performing Organization Name(s) and Address(es) Research Office Naval Postgraduate School Monterey, Ca 93943-5138	Performing Organization Report Number	
Sponsoring/Monitoring Agency Name(s) and Address(es)	Sponsor/Monitor's Acronym(s)	
	Sponsor/Monitor's Report Number(s)	
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes		
Abstract		
Subject Terms		
Report Classification unclassified	Classification of this page unclassified	
Classification of Abstract unclassified	Limitation of Abstract UU	
Number of Pages 54		

REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 2001	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE: Title (Mix case letters) Web-based Training for the Hellenic Navy			5. FUNDING NUMBERS	
6. AUTHOR(S) Stavritis Georgios				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE UL	
13. ABSTRACT (maximum 200 words) <p>The Hellenic Navy is looking to implement new ways of educating its personnel. Continuous training is a key to improve the performance of the personnel. Increased operational tasks are preventing participation of a large portion of active military personnel in traditional classroom seminars and courses. Distance learning is a solution, which eliminates the need for the physical presence of a student in a classroom. New means of communication such as computer networks can deliver a large amount of information practically to any place in the world. Those against distance learning methods, claim that the quality of distance learning courses is not equivalent to that of a traditionally taught course. In our work we taught the same course both in a classroom and on the Web. We compared the performance of the students in classroom to those taking the course online. Specific design principals were used for the Web site in order to achieve the best interface to deliver the course material.</p>				
14. SUBJECT TERMS Education, distance learning, Web-based Training, Online courses			15. NUMBER OF PAGES 54	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

WEB BASED TRAINING FOR THE HELLENIC NAVY

Georgios P. Stavritis
Lieutenant, Hellenic Navy
B.S., Hellenic Naval Academy, 1992

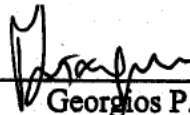
Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN COMPUTER SCIENCE

from the

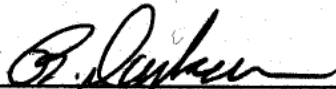
**NAVAL POSTGRADUATE SCHOOL
September 2001**

Author:

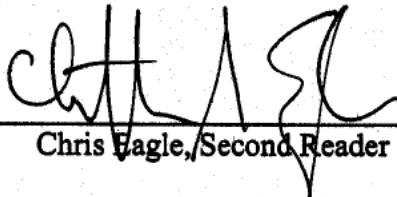


Georgios P. Stavritis

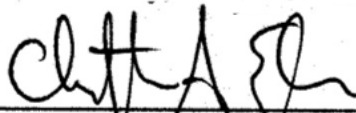
Approved by:



Rudolph Darken, Thesis Advisor



Chris Eagle, Second Reader



Chris Eagle, Chairman
Department of Computer Science

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The Hellenic Navy is looking to implement new ways of educating its personnel. Continuous training is a key to improve the performance of the personnel. Increased operational tasks are preventing participation of a large portion of active military personnel in traditional classroom seminars and courses. Distance learning is a solution, which eliminates the need for the physical presence of a student in a classroom. New means of communication such as, computer networks can deliver a large amount of information, practically to any place in the world. Those against distance learning methods, claim that the quality of distance learning courses is not equivalent to that of a traditionally taught course. In our work, we taught the same course both in a classroom and on the Web. We compared the performance of the students in classroom to those taking the course online. Specific design principals were used for the Web site in order to achieve the best interface to deliver the course material.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION ON DISTANCE EDUCATION	1
A.	 THESIS ORGANIZATION.....	1
B.	 OUR RESEARCH QUESTIONS	1
C.	 OUR MOTIVATION.....	2
D.	 WHAT IS DISTANCE LEARNING EDUCATION?	2
E.	 DISTANCE EDUCATION TODAY	3
II.	USING THE WEB FOR TRAINING.	5
A.	 WHY WEB BASED EDUCATION?	5
1.	Is the Web the right means?	5
2.	The Learning Environment and the Web.....	6
3.	Web-based Teaching.....	8
4.	Issues in Web-based Teaching.	9
B.	 WHY EVALUATE?	9
1.	What is DoD position?	9
2.	Why Start Early?	10
3.	Guidelines for Evaluation of Internet-Based Instruction.....	10
4.	How Should We Evaluate Distance Learning?	11
III.	HOW TO DESIGN AN EFFECTIVE WEB-BASED COURSE	13
A.	 INSTRUCTIONAL DESIGN AND USABILITY PRINCIPLES.....	13
1.	Instructional Design Principles.....	14
a.	<i>Course Presentation.....</i>	<i>14</i>
b.	<i>Web-based Instruction Principles.</i>	<i>14</i>
2.	Usability Principles (relating to Instructional Design).....	15
IV.	OUR EXPERIMENT.....	17
A.	 SELECTING THE APPROPRIATE GROUP OF STUDENTS.....	17
B.	 HOW THE DESIGN WAS IMPLEMENTED.....	17
1.	Implementing Instructional Design Principles.....	18
2.	Implementing Usability Principles.	23
C.	 SOFTWARE USED TO DEVELOP THE SITE	24
D.	 PROBLEMS ENCOUNTERED - SOLUTIONS	25
1.	Web-based Tests.....	25
2.	Student Identification.	25
E.	 QUIZ RESULTS	26
F.	 SURVEY RESULTS.....	27
1.	Survey One (Design principles)	27
2.	Survey Two(Content principles).....	30
G.	 FEEDBACK FROM BOTH SURVEYS.....	33
1.	Positive Comments.....	33
2.	Negative Comments	33
3.	Suggestions.....	33

V.	CONCLUSIONS	35
A.	SUMMARY OF RESEARCH RESULTS	35
B.	FUTURE WORK.....	36
	LIST OF REFERENCES.....	37
	INITIAL DISTRIBUTION LIST	39

LIST OF FIGURES

Figure 1	The Home Page of the Web-based Course Site.....	18
Figure 2	The Navigate Help Page for New Uers.....	19
Figure 3	Lesson 1, Page 3	20
Figure 4	Quiz 1	21
Figure 5	Correct Answer / Score Feedback Page.....	22
Figure 6	Question Submit Form.....	23
Figure 7	Chat Client and Discussion Room	24

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1	Test Results.....	26
Table 2	Survey 1 and Answers.	28
Table 3	Survey 1 Results (Graph).....	29
Table 4	Survey 2 and Answers.	31
Table 5	Survey 2 Results (Graph).....	32

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

I would like to thank my thesis advisor Professor Rudolph Darken for his assistance during my research. My wife, Nina, who supported me during my studies at the Naval Postgraduate School. And finally, all the Hellenic Navy Officers who are studying at the Naval Postgraduate School, and who gladly participated in our experiment.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION ON DISTANCE EDUCATION

A. THESIS ORGANIZATION

Before we get into the details of Web-based Training, we would like to give the reader an overview of this work's structure. In the introduction we summarized the questions that we answered and the motivation behind our research. We explained 'What is distance learning' and why it became such an interesting issue for the education community.

Then, in Chapter II, we listed the different forms of distance learning and focus on the use of the Web for delivering course material to students. Guidelines for evaluation of Web-based courses were included in Chapter II. In Chapter III, we summarized the theoretical designed principles of an effective Web-based course, both for interface and content. In Chapter IV, we explain how:

- We implemented the design principles mentioned in Chapter III to our Web site.
- We formed two classes of students, one online and one in classroom in order to compare their performance.
- We overcome difficulties developing the course
- We interpreted the research results

Finally, in Chapter V we presented the conclusions from our research, and posed some questions for future research.

B. OUR RESEARCH QUESTIONS

The main concern was to evaluate and to compare the performance of students who take a course online to the performance of students who take the same course in the classroom. Then, we wanted to identify the difficulties that arise when someone applies instructional and usability design principles to distance education Web sites. Thirdly, we studied the response of students to learning online. Fourth, we measured the time we needed to develop such a course and compared it to traditional courses. Finally, we gained experience on how to develop online courses.

In order to answer those questions, we passed through several steps:

- Step one: Search for design principles and known difficulties of Web design.
- Step two: Select the type of course, collect the course material and define the participating student's groups.
- Step three: Design the site from scratch and run usability tests.
- Step four: Select the platform to host our site and study the software program to develop the site with.
- Step five: Code the Web site and publish it.
- Step six: Offer the course in the classroom and online in parallel.
- Step seven: Evaluate the course using quizzes and online surveys.
- Step eight: Interpret the results of our survey.

C. OUR MOTIVATION

The motivation behind this research was the intention of the Hellenic Navy to develop organized distance learning courses for its personnel. The Navy is specifically interested in online courses that allow military instructors to develop courses but not interrupt their operational duties and also in giving the opportunity to a broader number of active military personnel to attend courses and seminars no matter where they are stationed.

D. WHAT IS DISTANCE LEARNING EDUCATION?

This is a natural question that is easier to ask than answer. This is true for the question "What is distance education" for several reasons. First, distance learning has multiple meanings. Distance can mean geographical distance, time distance, and possibly even intellectual distance. Second, the term 'distance education' has been applied to a tremendous amount of programs serving numerous audiences via a wide variety of media. Some use print, some use telecommunications, and many use both. Finally, rapid changes in technology challenge the traditional ways in which distance education is defined. Dan Coldenway of Canada's Athabasca's University, provided a framework useful in helping to define four ways in which education can be practiced. [ref 1 p.7] This framework, which considers the two variables of time and place, gives insight into

different approaches to the practice of education and distance education. Combinations of time and place, result in four approaches to education. The four are (1) same time, same place, (2) different time, same place, (3) same time, different place, and (4) different time, different place education.

Traditional education takes place at the same time in the same place. This is typically the regular self-contained classroom that most often is teacher centered. Different time, same place education means that individual learning occurs in a learning center or that multiple sections of the same class are offered so students can attend the class in the same place at the time they chose. This is education that is available at different times to students but in the same place, such as the media center or computer laboratory.

The last two categories focus on education occurring in different places. Instruction can take place in different places at the same time when telecommunication systems are used. Often, television is used to connect the local classroom with the teacher and the students to learn from a distance. Satellite, compressed video, and fiber-optic systems are increasingly used for same time, different place education. This approach is called *synchronous distance learning*.

Students can also learn at different times and in different places. Coldeway has said that the purest form of distance education occurs at different times and in different places [ref 1 p.8]. In other words, students chose when and where to learn and when and where to access instructional materials. Recently, World Wide Web courses have been offered to students anywhere they have access and whenever they choose. This approach is called *asynchronous distance learning*.

E. DISTANCE EDUCATION TODAY

In the last few years, distance education has become a major topic of education. In 1998, there were over 50 conferences dealing with some aspect of distance education and almost every professional organization's publications and conferences have shown a huge increase in the number of distance education related articles and papers. [Zvacek 2000].

Many educators are making grand claims how distance education is likely to change education and training. Certainly, the concept of distance education is exciting and recent hardware and software innovations are making telecommunications distance education systems more available, easier to use and less costly. Distance education has begun to enter the mainstream.

However, distance educators faced two fronts. First, students say they do not really want to learn from a distance. They prefer meeting and interacting with the learning group and the instructor in the classroom, seminar room, or the laboratory. Students report that they value the presence of learning groups, that the informal interactions that occur before and after class are valuable components of their learning experience. Second, there is evidence that students are increasingly demanding to be able to learn from a distance. They want to be able to supplement, and even place or replace, conventional learning experiences with distance education programs. Students say this is because there are many other course considerations besides personal preferences that motivate them, especially whether and when they learn.

These opposing preferences pose a dilemma for the educational community. Should resources be dedicated to improving traditional education with different structural buildings, classrooms, and offices, should students be transported to these facilities? Or should funds be used to develop modern sophisticated telecommunication systems? The trend seems to be towards communication.

Because of advances in technology, effective educational experiences can be provided for students, no matter where they are located. In other words, technologies are now available to develop cost-effective distance learning systems. The practice of distance education has dramatically changed in the last decade. Traditional approaches to distance education based on delivery and broadcast media technologies are no longer as relevant to the field in the United States as they once were.

Distance education is now often defined as institution based, formal education where the learning group is separated geographically, and when interactive data communication systems are used to connect students, resources, and instructors. [Albright, 2000]

II. USING THE WEB FOR TRAINING.

A. WHY WEB BASED EDUCATION?

1. Is the Web the right means?

Traditional universities face some basic questions when confronted with this new electronic environment. Can the Internet be used effectively for their educational purposes? Can Web-based teaching provide students with the same (or perhaps better) quality of learning as the traditional face-to-face environment? Should traditional universities go into Web-based teaching and compete with virtual or non-profit universities?

Well-established universities are re-examining their mission and looking for different or supplemental ways of accomplishing them (Berge, 1999; Laurillard, 1993; and Nasseh, 1998;) Such re-definitions of non-profit universities often includes the goal of providing life-long quality learning to as many students as possible without limitations of time, place, language, and individual economic status. In order to achieve this goal, universities are moving from their traditional emphasis on classroom instruction to an environment where learning can be pursued through any media of instruction, be it the classroom, television, or the Web.

Advances in information technology and telecommunications are allowing Web-based courses to replicate more seamlessly the features of face-to-face instruction through the use of audio, video, and high-speed Internet connections that facilitate synchronous and asynchronous communication in chat groups, Web discussion boards and virtual forums. Traditional instructional activities, such as lecture preparation, delivery, student participation, discussion, feedback, and evaluation can easily be translated to the Web environment. With the ever-growing demand for technologies that allow virtual classrooms to more fully replicate all features of face-to-face environments, market-pull forces, rather than a technology push-model are driving innovation.

Some of the strongest pressure for changes in higher education is coming from students. A growing segment of working, self-motivated students, want to acquire skills they feel are useful and also want to be able to choose how they will learn those skills.

Convenience is becoming increasingly important and there is a growing demand for education that is [Berge 1998]:

- Independent of time and space
- Oriented toward goals and outcomes
- Centered in the student/ learner
- Geared to active, hands-on learning and
- Able to accommodate differences in skills and language

2. The Learning Environment and the Web

The learning environment has two critical dimensions; time and place. We can classify this teaching environment into four major types:

- Type I. Same time (synchronous), same place in a traditional classroom. It represents the traditional face-to-face classroom where students congregate at the same time in the same place, to be taught simultaneously the same material by the same person.
- Type II. Any time (asynchronous), same place represents environment where students come at different times to receive instructions at the same place, such as a laboratory, library or an information center.
- Type III. Same time (synchronous), any place means distance learning, where students are from widely dispersed geographic areas and can be taught simultaneously through one-way or inter-active audio and video technology. .
- Type IV. Any time (asynchronous), any place has traditionally been represented by correspondence courses.

The Web can be used to support or simulate all four types of teaching environments. When synchronous teaching environments (Type I and III) are enriched with live Internet connections and projection capabilities, the Web can be used to support or simulate lectures, case discussions, and classroom interactions in multiple ways by:

- Serving as a platform for simultaneously delivering presentations (text, audio, and video) to students in a classroom (Type I), or dispersed throughout the world (Type III).
- Allowing synchronous virtual visits to sites dedicated to relevant topics or organizations.
- Enabling real-time or almost synchronous discussions through text-based technologies such as chat rooms and Web boards.
- When the Web is used in Type II environments, students gain access to an unprecedented wealth of multimedia information, tutorials, materials and resources to perform lab assignments, and to do library research at their own pace. They also gain the ability to interact asynchronously, outside of the class with their classmates, teams, and instructors through chat, Web board, or interactive Web based video technology.

In Type IV environments, the Web allows students to benefit from the anytime / anyplace flexibility of earlier correspondence courses, without having to sacrifice the spontaneity and interactivity traditionally associated with synchronous modes of instruction. This is where Web-based teaching achieves its maximum contribution in eliminating time and space barriers, while still achieving interaction.

When the Web is used to create a Type IV environment education and human contact are available anytime from anyplace. Students can learn from home, office, or wherever they are, by accessing Web-based lectures, tutorials, materials, and books. They can complete and submit Web-based assignments, exercises, and research interacting in Web-based forums and taking Web-based quizzes and exams.

A few words of caution are needed at this point. Although the Web can support and even replicate all four types of teaching environments this does not necessarily mean that it will. For example, if a traditional university encourages or forces all instructors to use the Web to support a Type I teaching environment, the quality of instruction may suffer. Instructors who are technologically inclined may become so enamored of the technology that they concentrate on form rather than content in their instruction.

3. Web-based Teaching.

The information interaction capabilities of the Web have led to the development of exclusively Web-based courses where all or almost all teaching takes place on the Web with little or no face-to-face interaction. This mode has several variations depending on decisions made in the following areas.

First, course development:

1. The faculty member who will teach may develop the Web course.
2. Another faculty member may develop the course and then supervises the teaching faculty.
3. A team of instructional and Web specialists either in-house or by contract with an external company may develop the course.

Secondly, places of course delivery:

1. The course can be entirely Web-based with faculty and students never meeting face-to-face and with students in places all around the world.
2. It can be taught mostly in the Web with a few face-to-face interactions required usually in the beginning and at the end .
3. The course can be taught in a mixed mode with some students in the classroom, supported with Web information interaction and others taking the course entirely on the Web.

Thirdly, timing of course delivery:

1. The course can be structured so that there are time limits for students to complete the units or module. For example the course starts and ends at a certain date and the course or units or topics are taken in locksteps by a cohort of students within a certain time.
2. Or the course can be taken without time limits. For example, the students are free to progress at their own pace through the materials indefinitely.

Fourthly, level of interaction:

1. The course can place a varying degree of emphasis on using the Web for the transmission of information for interaction between students and faculty. It is always possible to use the Web as a part of rather than a complete Web supported course.
2. Or no emphasis can be given leaving students to decide for themselves.

4. Issues in Web-based Teaching.

Many technical administrative, and pedagogical issues arise when traditional universities use the Web to become fully Web-based anytime and anywhere educational environments. Technical issues involve constantly changing hardware and software used in Web-based teaching. Administrative issues include the logistics of providing remote students with the same support available as on campus. Students for example may need access to the library, bookstore, advising, registration, and carrier services, etc. Pedagogical considerations involve the challenges of quantity control.

B. WHY EVALUATE?

1. What is DoD position?

Evaluation is about collecting data to judge the merit and worth of any aspect of a program. Recently, the Department of Defense (DoD) has embarked on a DoD-wide endeavor to implement Advanced Distributed Learning (ADL). According to the Department of Defense Strategic Plan for Advanced Distributed Learning (Office of the Under Secretary of Defense for Personnel and Readiness, April, 1999), the Secretary of Defense's vision of training technology is "to ensure that DoD personnel have access to the highest quality education and training that can be tailored to their needs and delivered cost-effectively, anytime and anywhere."

DoD's ADL program is making an important investment in the development of Internet-based resources that provide high-quality instruction and performance support strategies to include development of the network infrastructure needed to support them. Right now, while distance learning efforts are in the planning stages, it is important to think in terms of the data needed to provide convincing evidence of the merit and worth

of distance-learning programs. In other words, we need objective evaluation guidelines that will help answer some important questions. The guidelines should address questions like, "Is the instruction and performance support of high quality?" "Do students find distance learning resources convenient, useful, and tailored to their individual needs?" and "can distance learning resources be delivered cost-effectively?" [ref 9 p.3]

2. Why Start Early?

Planning for DL evaluation is important because it is easier and less expensive to make changes at the beginning of a program than at the end. Evaluation can not be tacked on as an afterthought. Evaluation planned from the start and kept high on the agenda can produce useful results with modest resources (Draper, 1999).

When evaluation is done early during the design and development stages of a product, it is by convention called *formative evaluation*. Formative evaluations contribute to an evolutionary approach to development. Early evaluative judgments of portions of a DL product, as they are developed, can efficiently affect improvements in the product, and evaluative feedback is a form of quality control. Judgments of effectiveness after implementation of the product are called *summative evaluations*. Summative evaluations address the whole DL product (e.g., resource center, course) and promote evaluation of the product in the wider context in which it is used. They are also used to compare alternative solutions.

3. Guidelines for Evaluation of Internet-Based Instruction.

The Department of Defense (DoD) has established the Joint Advanced Distributed Learning (ADL) Co-Laboratory to support the implementation of DL within DoD. The function of the Joint DL Co-Laboratory in Orlando, is to promote collaborative and rapid development of DL prototypes and DL system acquisitions, principally among the Services' training systems development components. As part of the DL initiative, the Joint Co-Laboratory is to provide technical assistance to program managers responsible for the development and fielding of DL systems.

The goal is to establish documented guidelines for the design and evaluation of Internet-based training and performance support. Scientifically validated principles for design are not yet available to support journeyman development of DL material. It is

hoped that the guidelines will reflect the needs of DoD and will be aligned with DL goals and user requirements. The University of Central Florida's Institute is developing the guidelines for the Joint DL Co-Laboratory for Simulation and Training [ref 10].

The preliminary evaluation guidelines, which are the focus of this report, do not yet comprise a DoD directive, implying mandatory compliance with "standards." Rather, they have been compiled to provide the best available guidance and direction to evaluation and improvement efforts, which support the development of high quality DL products. Adherence to the guidelines is recommended, but not required.

4. How Should We Evaluate Distance Learning?

Evaluations can be conducted in many different ways and the evaluation data can serve many purposes. The two methods of evaluation, the content and design checklists, and the evaluation rating scales, are needed in the early stages of DL program planning in order to give direction to developers of DL resources. The scope of future distance learning evaluations will depend on the answers to a number of questions:

- 1) Who is the evaluation for?
- 2) What is the purpose of the evaluation?
- 3) What can be measured, given the time and resources allocated?

Organizations with distance learning programs will decide the scope of evaluation by making decisions about what outcomes will provide the best feedback for distance learning improvement and best determine the effectiveness of their distance learning programs. Programs can begin with an evaluation of the design and content of a distance learning product. Instructional developers, content experts, and other interested stakeholders can continually assess the product, as it is being designed and developed. Then, when all or part of the product is developed, users can evaluate the usability of the product and the usefulness of the information it provides. Learning and performance outcomes can be obtained by assessing users themselves, interacting with the product. Finally, after distance learning implementation, its use and effectiveness within the organizational context can be evaluated. As the evaluation effort is expanded, the expense and complexity of measures increases. Many organizations are in the relatively early

stages of the distance learning planning-design-development-implementation process, making this a good time for them to plan how distance learning will be evaluated throughout all of the stages. In the best of all worlds, as distance learning resource centers and other distance learning systems are designed, formative evaluations will contribute to highly evolved, high quality products. Then, as distance learning products are implemented, they will be subjected to summative evaluations according to an organization's distance learning plan.

III. HOW TO DESIGN AN EFFECTIVE WEB-BASED COURSE

A. INSTRUCTIONAL DESIGN AND USABILITY PRINCIPLES.

These instruction design principles (Stefanyshyn, 2001) are basic guidelines for instructors on how to construct a Web-based instruction course. We believe that to have an effective online course, four aspects are required:

1. A Reliable System: Nowadays, Internet access is available to most people. Students who bought a computer system within the last five years can use it to access Web sites. The hardware requirements for viewing Web pages are met most of the time with a typical system. More modern hardware and software may be required for the site itself but that's outside the scope of our research.
2. A Well-Designed Course to Capture the Student's Interest: The first impression is of great importance. Users should find what they are looking for at 'a blink of the eye'. Otherwise they will probably click their mouse to another site. To avoid this in Web-based instruction, the instructor needs to present an interesting modern first page representative of well-organized and interesting content.
3. A Usable System: Regardless of the content, the courseware used needs to be easy to learn and use. The system should not cause problems for the students.
4. Allow Instructors to Work from a Checklist: 'Instructors comment that time and the lack of training are the most common problems in putting an online course together. A checklist that assists instructors with putting an online course could alleviate the time and burden instructors have with putting a course online. The difficult part is standardizing a generic checklist to help instructors.' [Stefanyshyn, 2001]

We collected information from traditional literature and empirical research on instructional design and usability principles. We then divided the research into two groups: Instructional design principles and Usability principles. We further expanded these two groups into smaller sections for better understanding. The two groups and its principles are [Stefanyshyn, 2001]:

1. Instructional Design Principles

a. Course Presentation.

- Present the material in simple and understandable paragraphs: There is a difference to interaction between being in a classroom with an instructor and being in front of your computer screen reading a course online. In the classroom the instructor may correct himself on the fly, in contrast to a text or an image online that has to be correct from the beginning. If the students do not understand a concept, the instructor may paraphrase his words and explain what he meant to say. That is not possible for an online course.
- Keep the content organized and as consistent as possible: “One of the more important rules in designing instruction is to have consistency among content, instructional objectives, and student practice, all leading to an evaluation that matches the practice on which students have been receiving feedback” (Berge 1998 p.73). Each paragraph and section has to be clear and consistent. To ensure that students read the content and were not distracted, hyperlinks should be placed at the end of content.
- Guide the students from one location to another: Links and hyperlinks provide quick access to updated information all over the world. While book readers turn pages, online students click on links to see the next page. Those links have to be obvious and simple, and link to the correct page. Otherwise, students may find themselves lost in the Web.

b. Web-based Instruction Principles.

- Getting the student started: The site must attract student’s attention and convince him that he found what he was looking for.
- Presenting the subject material: Keeping the student interested in the course is very difficult. In the classroom, the instructor may notice that students get bored, while he cannot do so in a Web course. The amount of

reading and assignments should not overload students, but should be given as modules.

- Assessing the subject material: One way to measure progress is through quizzes and assignments. Instructors should consider that, “to improve student learning performance, the test should match the kind of information that was learned and the given test should match the expected test” (Najjar. 1999 p. 319).
- Assessing the course: Students can give the best feedback, because the course is targeting them. If the students are not satisfied with the course, there will be no interest to join another course. Their comments are vital to improving the quality of a course.
- Assessing the usability of the courseware: The students evaluate their online experience at the end of the course to determine the ease of access to the program, delivery of the material, and support (mainly technical). (Hayes. 2000 p. 132).

2. Usability Principles (relating to Instructional Design).

- Ease of learning: Students want to learn the course material and not the application that delivers it. The less effort they put to learn the interface, the quicker and easier they will concentrate their attention to the course. We must consider that users dislike reading help manuals and pages. Only when they become confused or lost when completing a task, they consult “Help”. The courseware needs to be simple and flexible in order for the students to learn the application and for the instructor to design the course.
- Ease of use: ‘If users have to continually struggle with a system while learning, users may develop a negative attitude towards distance learning, something that should be averted if ease of use is taken into consideration. Students should be able to use the material with ease or very little difficulty regardless of user ability.’ (Stefanyshyn 2001).

THIS PAGE INTENTIONALLY LEFT BLANK

IV. OUR EXPERIMENT

A. SELECTING THE APPROPRIATE GROUP OF STUDENTS

All our theoretical arguments are not enough to justify the use of the Web for training. We need to compare the results from a course taught in a classroom (traditional) and the same course taught online (Web-based training), to see how students will perform in each case. Before we proceed to the course, and in order to have interpretable results, we used a checklist as stated in Design consideration for distance-learning evaluations [Matthew Champagne and Robert Wisher, p.277], and requires the following:

- The existence of a comparison group.
- Randomly assign students to groups.
- Groups comparable in terms of age, education, experience, and other relevant predictors of outcome.
- Plan before the training begins.
- Give a pre-test of relevant knowledge and skills.
- Administer a valid or reliable post-test.

This study is an evaluation for the Hellenic Navy. Therefore, we have selected to bring online a current military course. For the purposes of our study, we have selected junior officers of the Hellenic Navy, currently students at Naval Postgraduate School, to be our students and e-students. They were split into two groups, one of them would do the course in the classroom, and the other group would take the class online. The same course material was used for both classes, which took place the same period. The same instructor would design the Web course and teach the classroom course. In this way, the results would be interpretable.

B. HOW THE DESIGN WAS IMPLEMENTED

We have briefly discussed the design principles in chapter three. That was the theoretical approach on the subject. Inexperienced programmers tend to spend no time designing their program's structure and start writing code. We spend several days in order to combine all the design principles and to implement them.

1. Implementing Instructional Design Principles

- Present the material in simple and understandable paragraphs: The course was split into three lessons. Each lessons was consisting of four to five pages of text and tables. Reading a lesson would take from fifteen to twenty-five minutes. Each quiz would take ten to fifteen minutes.
 - Keep the content organized and as consistent as possible: Only content related information was presented. Hyperlinks were placed at the end of the lesson for further reference. Each lesson was followed by a review summary that pointed out the key concepts of the lesson.
 - Guide the students from one location to another: Next and Previous page buttons were located on the top and bottom of each page. Additionally a home button was used to help users navigate while a bar-drop down menu was providing link directly to lessons, quizzes, contact, and help pages.
- (See Figure 1)

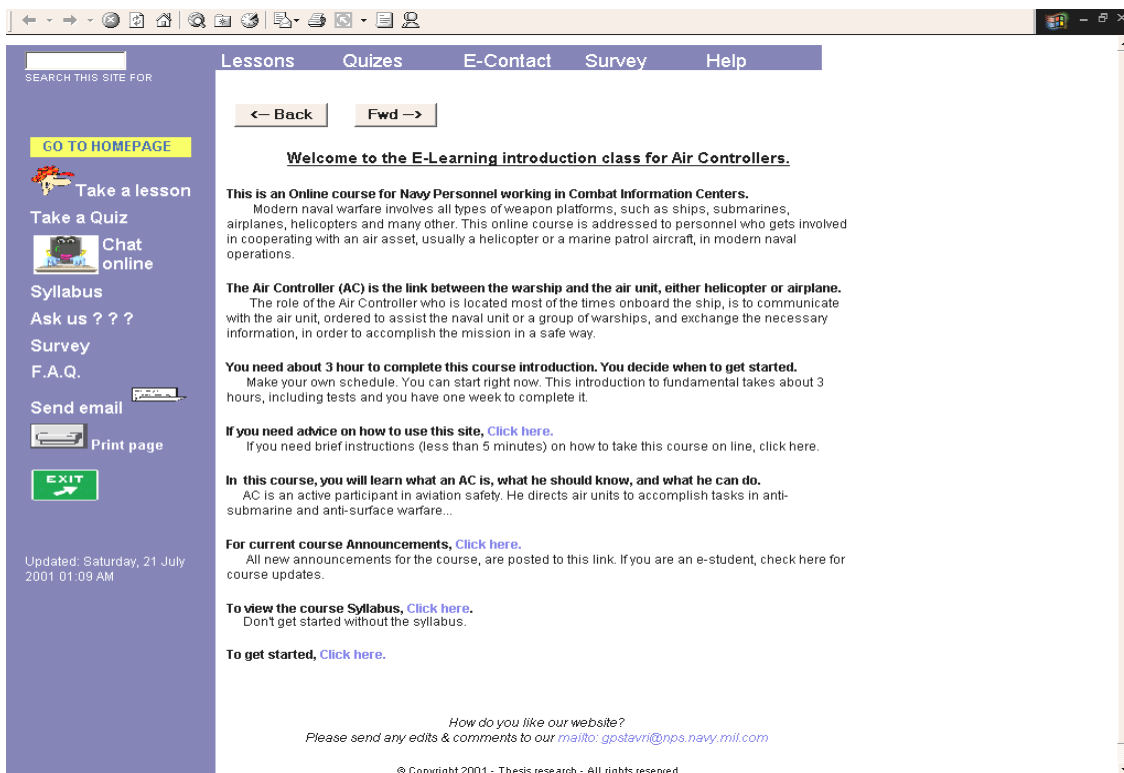


Figure 1 The Home Page of the Web-based Course Site.

- Getting the student started: The home page (Figure 1) was the most important page of the site, because we wanted to get the student's attention and give him 'the big picture'. A welcome message was followed by a brief description of the site's content. After that, we informed the students that they would need to devote approximately three hours in order to complete the course and the surveys. That was important because previous usability tests indicated that, users were paying more attention on how much time they had to spend to complete the course and the description of the course than anything else. Special care has been taken for new users who have never before had the experience of a Web-based training. The first link in the homepage was a help page on how they would navigate the site, what they were supposed to do, and links to frequently asked questions (Figure 2).

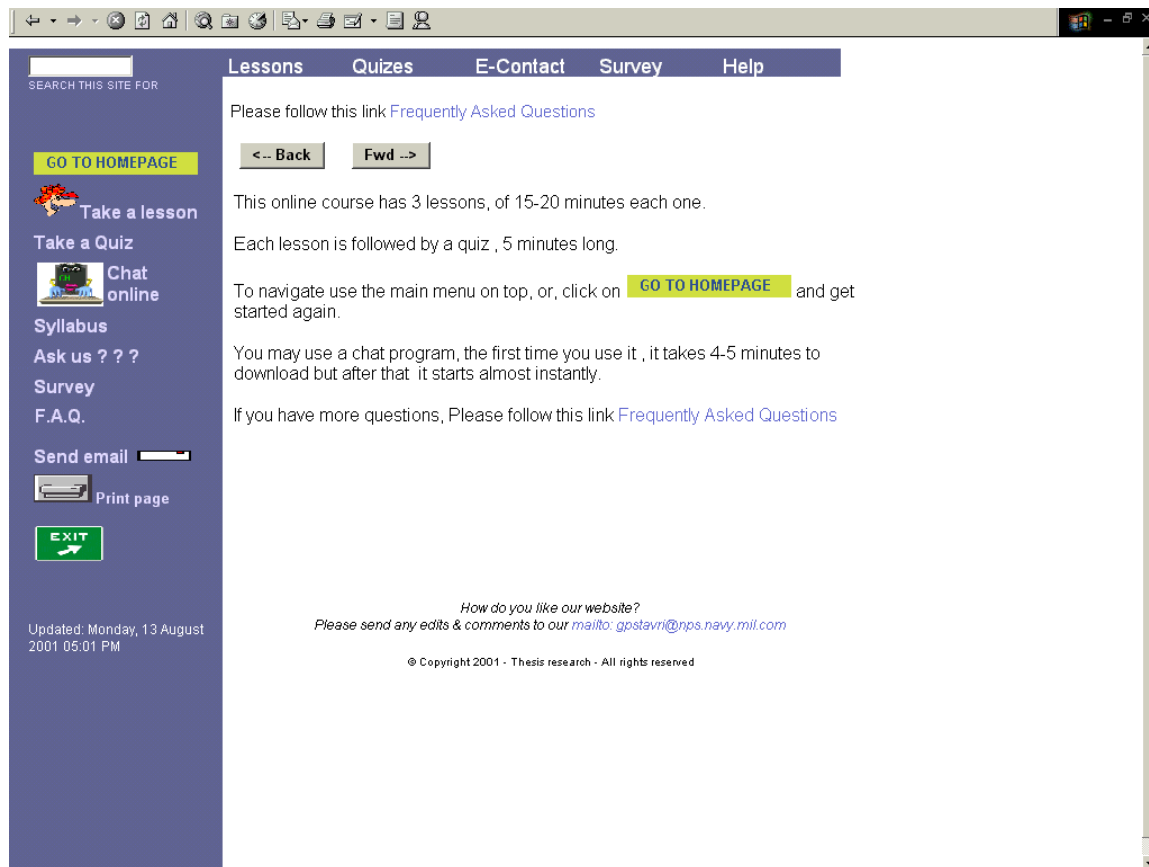


Figure 2 The Navigate Help Page for New Users

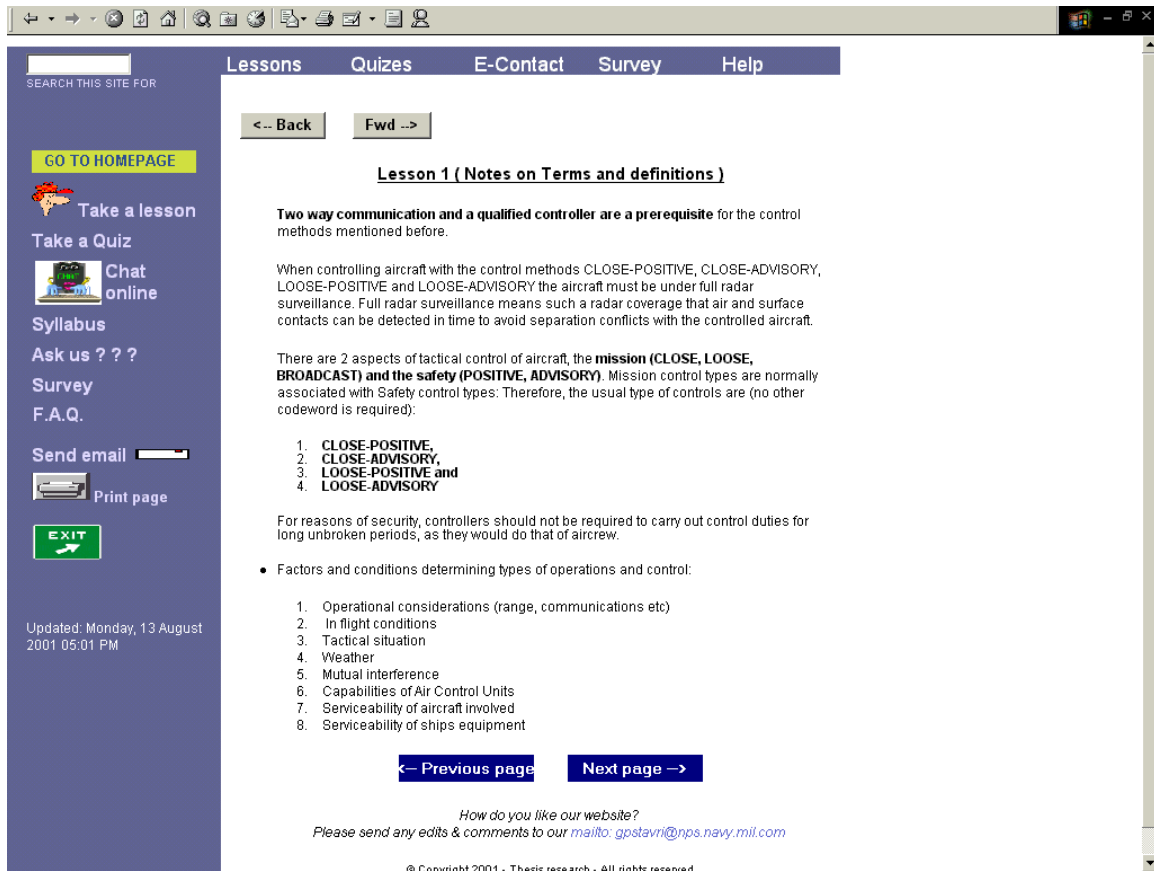


Figure 3 Lesson 1 Page 3

- Presenting the subject material: The classroom course was scheduled as all similar courses at NPS, but only for three sessions of 45 minutes each (Monday through Thursday) and an in class quiz the following Friday. At the same time, students went online a given a week, from Wednesday to the following Tuesday, any time they wanted. The only restriction was that the quiz had to be submitted online by Tuesday noon at the latest. Students had the option to print out all the content in a printer friendly form, without menu bars and buttons. A print button was available, in case they wanted to print the text of one or more pages of the course to read it off the computer screen. As soon as a lesson was completed (Figure 3), a review page was available to give a summary of what was taught so far. At this point, students were asked if they wanted to proceed to the quiz or take a pause and come back later. Thus, they could prepare themselves for

the test, and take it when they would feel ready. Of course, they had a time limit of one week to complete the course.

- Assessing the subject material: Both classes would be tested at the end of the course, using the same quizzes. Because of the nature of the Web-base training, quizzes had to be on a multiple choice or true/false statement (Figure 4). It was vital on the success of the learning process, to give e-students instant feedback on the correctness of their answers and their final score, because then they could proceed to the next lesson without delays. As soon as the quiz was submitted, the score and the correct answers were displayed on the screen (Figure 5). Students could repeat a quiz, but for our survey only the results from the first quiz were considered. All answers were stored in our database for future reference.

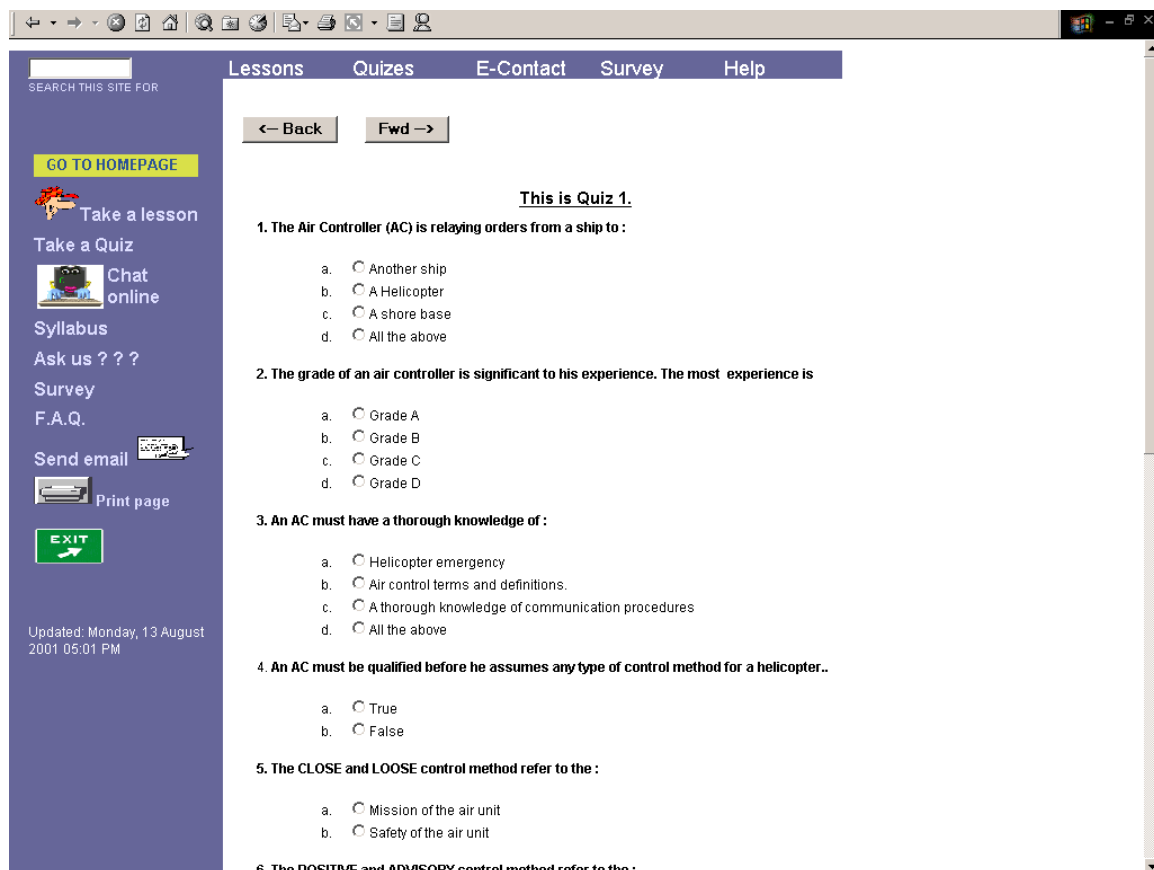


Figure 4 Quiz 1

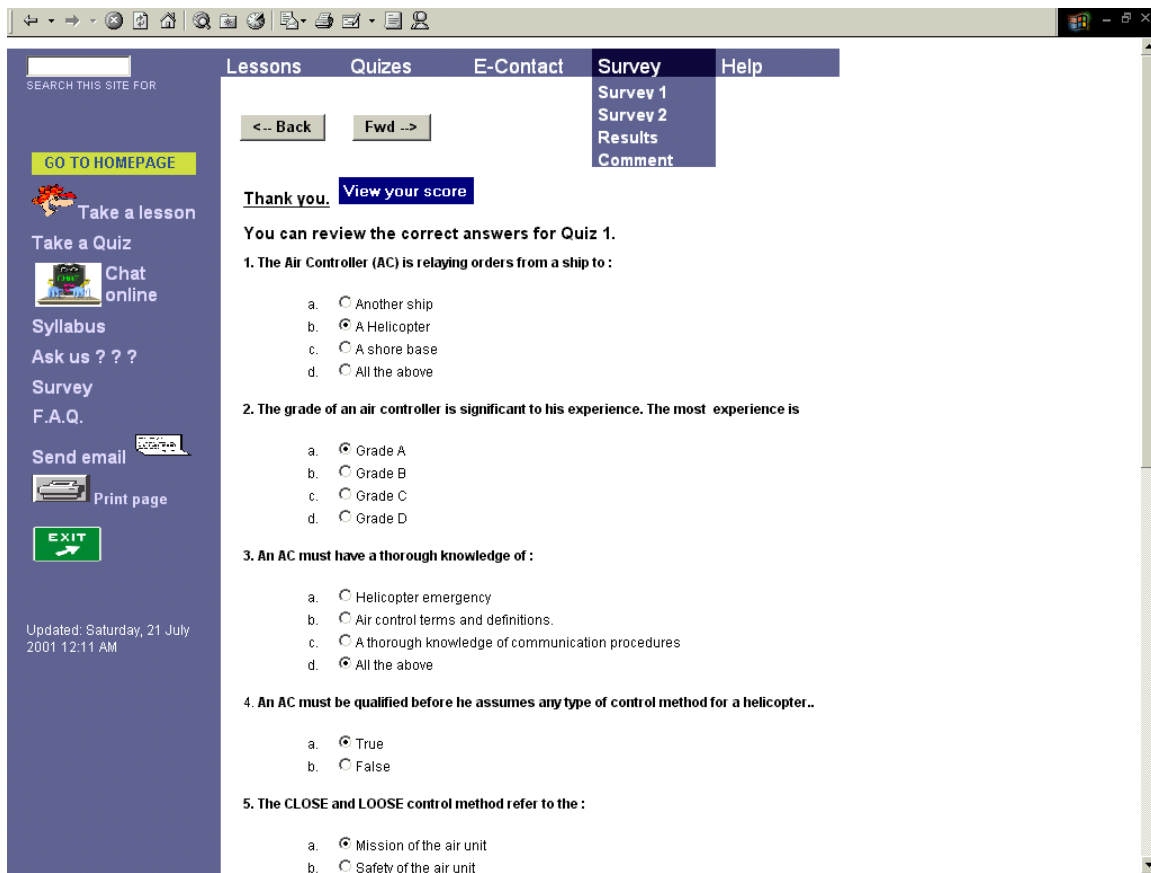


Figure 5 Correct Answer / Score Feedback Page

- Assessing the course and the usability of the courseware: Participants answered an online questionnaire, in order to measure the effectiveness of the Web-based course, both on design and content. We preferred the Web-based surveys for various reasons. Thanks to standard browsers, little or no user training was required. The participants would feel more comfortable to answer anonymously, rather than face-to-face. The results would be interpreted statistically. Participants chose when to answer the questions. To speed up that process, the questionnaires were placed just after the online quiz tests. The results were manipulated easier and faster through our Web database. And the results were more reliable compared to those of off-line methods.

2. Implementing Usability Principles.

- Easy of use: As far as easy of use, a standard Web browser was sufficient in order to access the web site. The interface has been tested through usability tests before it was available online. So students had to put little or no effort to learn the environment.

SEARCH THIS SITE FOR

GO TO HOMEPAGE

Take a lesson

Take a Quiz

Chat online

Syllabus

Ask us ???

Survey

F.A.Q.

Send email

EXIT

Updated: Monday, 13 August 2001 05:01 PM

Lessons Quizzes E-Contact Survey Help

← Back Fwd →

Question Submit Form

Please fill in the following form:

From: Must be a valid email address like you@host.com

To: gpstavri@nps.navy.mil

Your Name (optional)

Your question:

Submit Reset

My Email Address: gpstavri@nps.navy.mil

Last Updated: 08/13/2001

How do you like our website?
Please send any edits & comments to our mailto: gpstavri@nps.navy.mil.com

Figure 6 Question Submit Form

- Ease of learning was achieved as follows: In a traditional classroom, students may ask questions directly to the instructor. In a Web-based course, this interaction can be done in three different ways. A student can send e-mail to the instructor, he may post a question, or he may join a chat room and participate in an online discussion. All these options were available to our students. Students could send their questions, even without an email program (Figure 6). As an option, a chat server (a

program that allows users to connect and chat online) was running to our site, and students could open a chat client and join the course discussion room. (Figure 7).

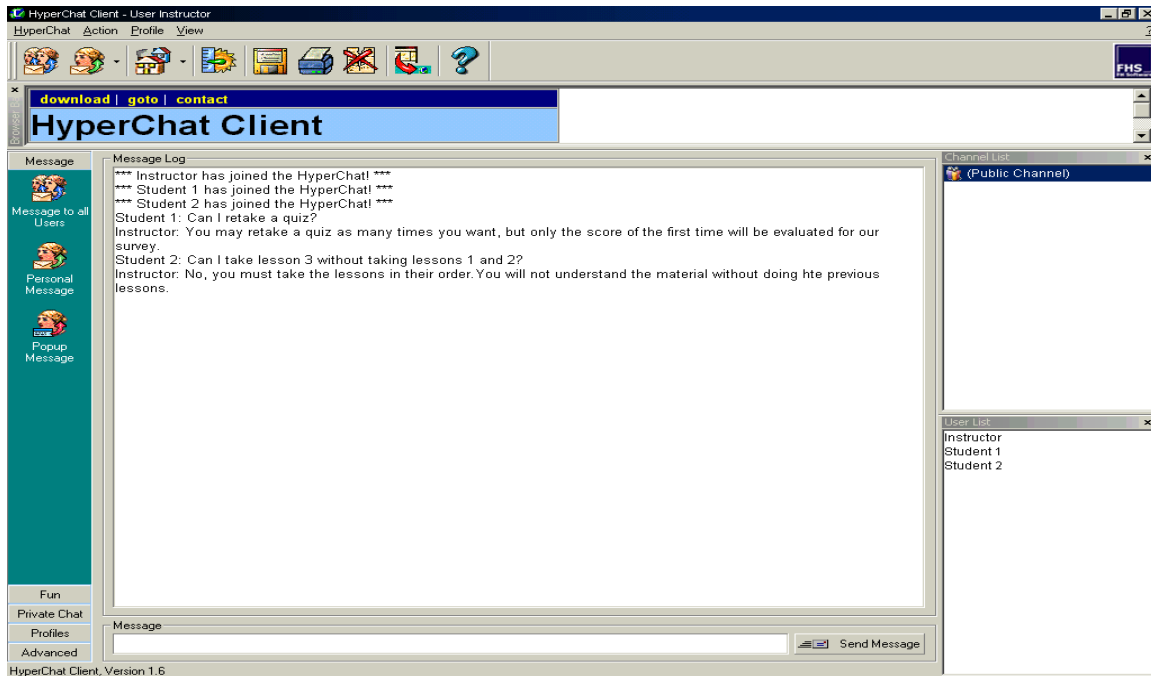


Figure 7 Chat client and discussion room

C. SOFTWARE USED TO DEVELOP THE SITE

The platform that hosted our site was a Windows 2000 Server, running Internet Information Server Version 5 (IIS 5.0). Microsoft Front Page 2000 was our Web page design tool for .html and .asp as well. Microsoft Access 2000 was used to create the database that kept all our data, both scores and survey. The site was published at the following Web address <http://www.movesinstitute.org/elearning>, on July 14th 2001, and is scheduled to go offline by October 1st 2001. A freely distributed chat server and client were used to host our online chat rooms [Hyperchat suite version 1.6 copyright 1998-2001 FH software, <http://fhsoftware.tsx.org>, May 2001].

D. PROBLEMS ENCOUNTERED - SOLUTIONS

1. Web-based Tests.

There are several advantages in Web-based tests over the traditional paper and pencil tests. Numerous researchers (Bugbee 1996, Lloyd 1996, Glowacki 1995) have indicated their advantages as the following:

They have enhanced control in presenting item displays and greater standardization of test administration.

- They offer improved test security.
- They enrich display information.
- They provide equivalent scores with reduced testing times.
- They reduce measurement error.
- They improve the coding of responses.
- They can be automated for individual administered tests.
- They can obtain record at a central site.
- They have immediate test scoring and feedback.

Furthermore, they reduce scoring time by 70% to 80% and they provide a simple mechanism for storing and retrieving valuable information. Lee (1986) shows that past computer experience significantly affects performance on Web-based tests. As this type of test may discriminate against those who have no experience in computer usage, administrators need to take into account the student's previous knowledge and experience in information technology (Heywood 1989).

2. Student Identification.

Validation of the user and the authenticity of the submission of a test are challenges in the Web environment. Open Web access allows anyone to sit for a test or to complete a written report on behalf of another. Although password access has been recommended, it would be useful to look beyond more than one form of assessment. Consistencies between synchronous and asynchronous modes of course participation could be reviewed and tracked for further insights. Short and frequent impromptu dialogs or interventions in the understanding of course material may be useful. An alternative, facility like a computer room with some form of supervision would help to reduce the

risk of cheating in a test. It must be admitted that authentication over the Web is still an issue. In our study, since there would be no personal benefit or detriment for the participants who were users e-student 1 through 10, no further consideration was taken on this matter.

E. QUIZ RESULTS

All students, both in the classroom and online, completed the course on time. They have been tested, and their scores are shown in the following table.

Web-Based Training.		In Classroom Training	
Name	Score	Name	Score
E-Student 1	100	Student 1	90
E-Student 2	100	Student 2	100
E-Student 3	100	Student 3	80
E-Student 4	60	Student 4	90
E-Student 5	100	Student 5	100
E-Student 6	90	Student 6	90
E-Student 7	70	Student 7	100
E-Student 8	100	Student 8	80
E-Student 9	80	Student 9	100
E-Student 10	90	Student 10	70
Average	89.0	Average	90.0
Std Deviation	14.49	Std Deviation	10.54

Table 1 Test Results

Statistically there is no difference between the performance of students in the classroom and online. The web-based course matched up well with the traditional course. The mean is both groups is close to each other and the deviation is small, therefore the scores were concentrated near the mean score. In other words, the online course matched up well to the classroom course. Because of the nature of multiple-choice questions, some students may have just recognized the correct answers in both classes. Even if this is the case, they had the same chances, either in class or online.

F. SURVEY RESULTS

Besides the scores, there are some interesting results from the surveys, which will be explained shortly. Our survey had two parts, design evaluation and content evaluation. Survey questions and answers are shown in Tables 1 and 2 respectively.

1. Survey One (Design principles)

The purpose of the first survey was to evaluate the design of the Web-based course. Students, through their answers indicated that the Web site was presented online in the form we initially intended. First of all, users had no problem with the computer and the browsers. Pages were loaded fast over usual modem connections. Navigation through pages was very simple and students could “walk” through the various pages without problems using multiple navigation buttons. The following table shows the questions asked, and the positive or negatives answers submitted by the participants.

		Yes	No	
1	Are you familiar with using a computer?	10	0	
2	Did you connect to the e-learning site easily?	10	0	
3	What connection did you use?	Modem 9	LAN 1	
4	Were most pages loaded in less than 5 seconds?	9	1	
5	If a page needs more than 10 seconds to be loaded, were you informed?	5	2	NA 3
6	Did you navigate easily thought the site?	10	0	
7	Did you find instructions on how to navigate and use the site?	9	1	

	and use the site?			
8	If yes, was it helpful?	10	0	
9	Did you use the help option?	3	7	
10	If yes, was it helpful?	3	0	NA 7
11	Were there Back and Forward buttons?	9	1	
12	Did you have a Home button at every page you visited?	9	1	
13	If yes, was it helpful?	9	0	NA 1
14	Were you ever lost?	0	10	
15	To navigate, you used most?	All 3	Options	
16	Were the fonts read easily on every page?	9	1	
17	Do you think that the hyperlinks were at the proper place?	10	0	
18	Did you follow any link?	8	2	
19	If yes, on average did you spend more than 3 minutes to the linked page?	5	3	NA 2
20	Did you follow any links on the linked pages?	8	0	NA 2
21	Did you find a description of the course in the home page?	10	0	
22	Did you find the syllabus easily?	10	0	
23	Did you spend more that 20 minutes to complete a lesson?	9	1	
24	Did you spend more that 30 minutes to complete a lesson?	0	10	
25	What did you liked most?	Discussed	Separately	
26	What you didn't like?	Discussed	Separately	
27	Any suggestions?	Discussed	Separately	

Table 2 Survey 1 and Answers

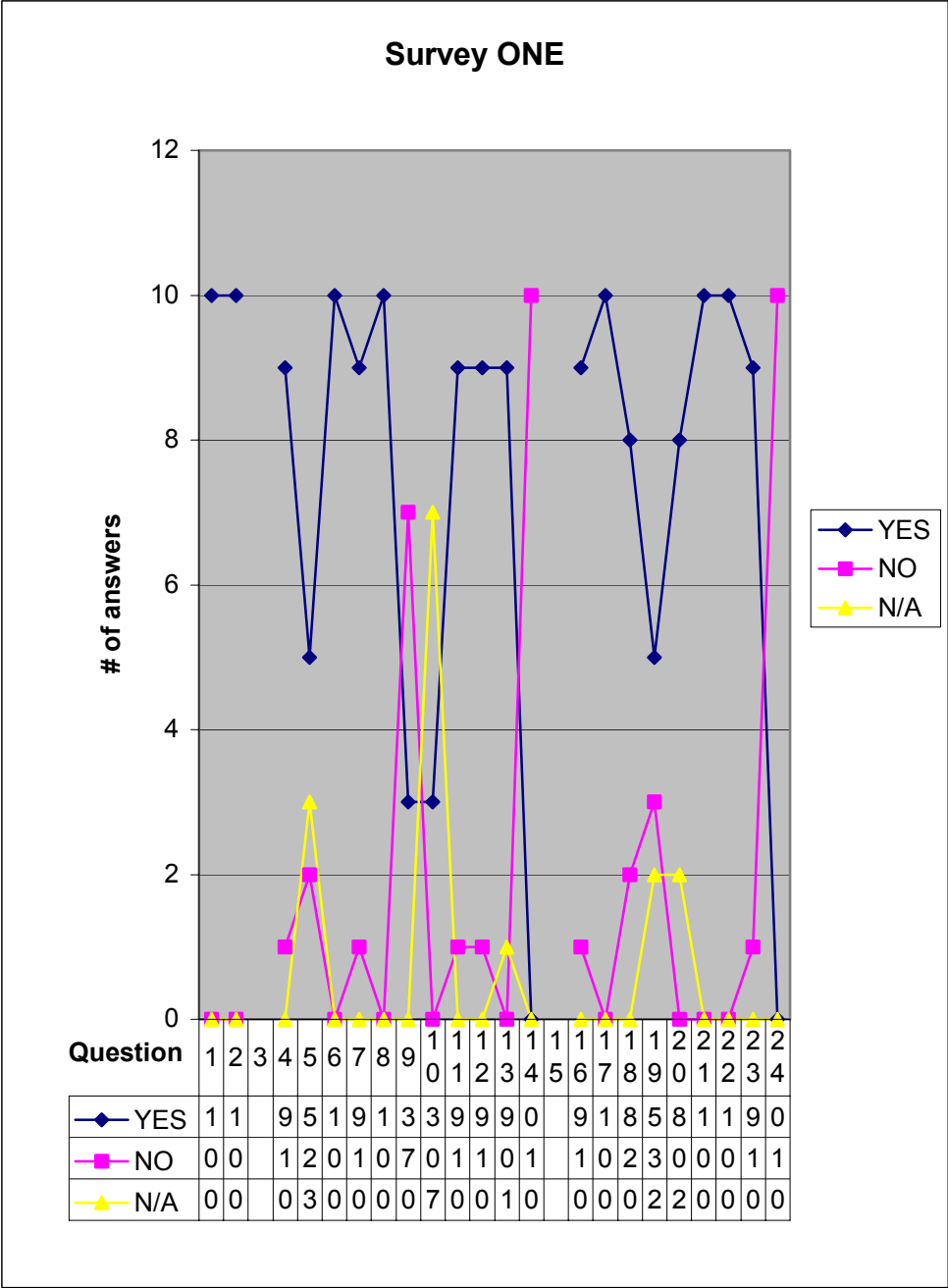


Table 3 Survey 1 Results (Graph)

2. Survey Two(Content principles)

The purpose of the second questionnaire was to evaluate the content of the Web-based course. The general impression of almost all the students is that they liked the online course. Most of them would prefer courses online.

		Yes	No	
1	Were you informed about what you would learn at that site?	10	0	
2	Did you surf the site before start taking the course?	7	3	
3	Were requirements to successfully complete this course clear?	9	1	
4	Did you feel comfortable to ask any questions?	7	1	NA 2
5	Was it easy to ask a question online?	5	2	NA 3
6	Did you ask any questions?	2	8	
7	Did you answer any questions?	3	7	
8	How many times did you use email to contact the instructor?	None: 8	1-3 times:2	
9	If yes, did you get an answer in time?	1	1	8
10	How many times did you use email to contact another student?	None 10		
11	If yes, did you get an answer in time?			10
12	How many times did you use the chat option to contact the instructor?	None		
13	If yes, was the instructor available?	2	1	
14	Was any student online?	2	1	
15	Do you think the pictures at the site were relevant to the content?	8	2	
16	Did you find the information irrelevant to the subject of the course?	2	8	
17	Do you think there was too much information on the site?	1	9	

18	Do you think there was a logical transition from one page to the next one?	10	0	
19	Do you think that information was up to date?	10	0	
20	Did you print any page to read off line?	2	8	
21	If yes, was it helpful?	2	0	NA 8
22	Did you take the quizzes within 1 hour after reading the lesson?	8	2	
23	Do you think that the questions were within the content?	10	0	
24	Did you find the course interesting?	9		NA 1
25	If you could take the course in class or online, what would you choose?	8 Online	1Class room	NA 1
26	Would you suggested to other students to take this course?	8	0	2

Table 4 Survey 2 and Answers.

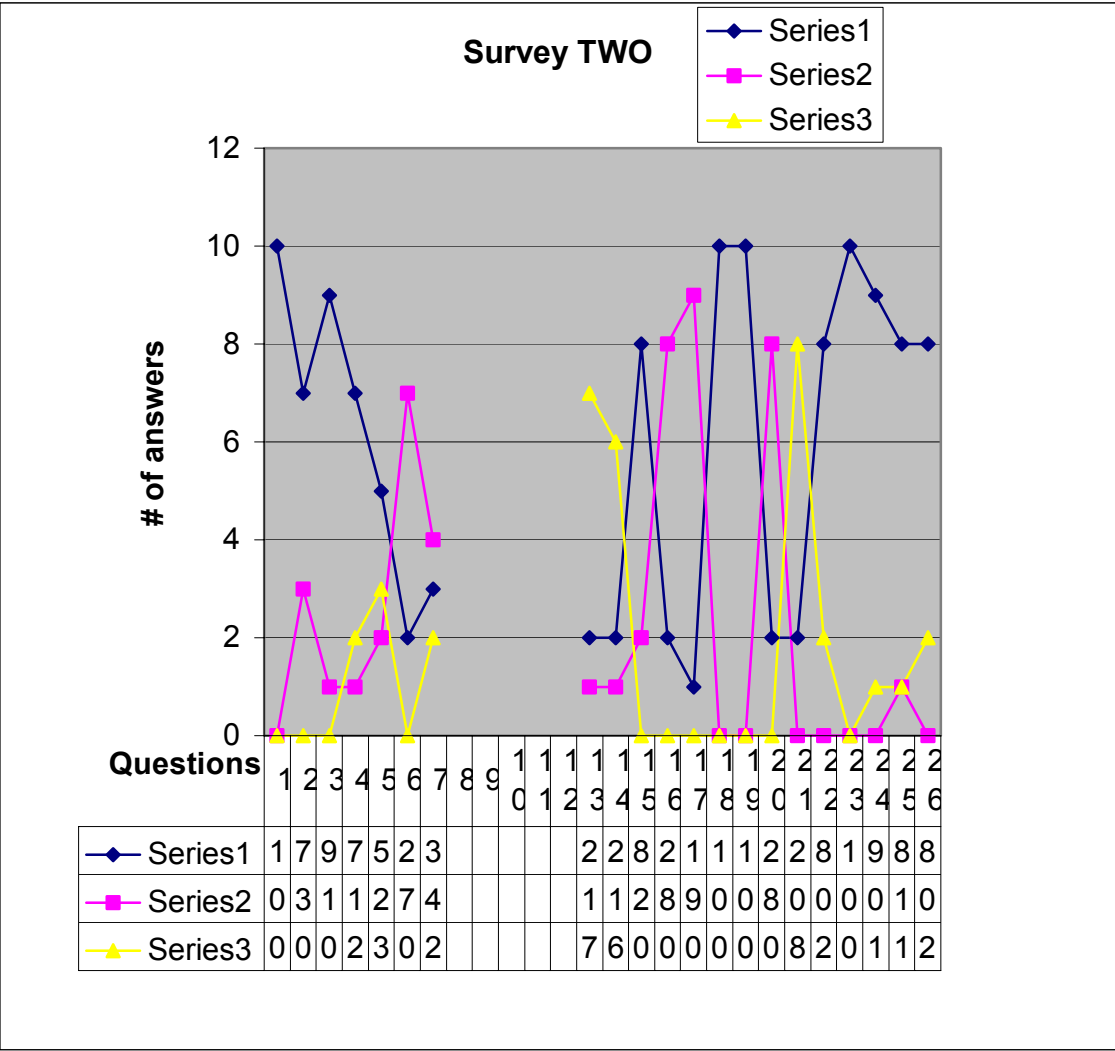


Table 5 Survey 2 Results (Graph)

G. FEEDBACK FROM BOTH SURVEYS.

Besides Yes and No answers, the participants were requested to make free comments. Participants were asked to comment what they like, what they didn't like and suggest improvements. It was very encouraging to find that participants submitted many comments and suggestions that enriched our survey.

1. Positive Comments

Most of the comments were very supportive of this effort. They were impressed by the organized course, the navigation options (a menu on top of page, a side bar, and embedded buttons inside the pages which guided them through the course), and the up-to-date information. Almost all found the course interesting, and admitted that they would suggest something similar to their friends. The lack of negative comments on design and presentation of the site was definitely a positive result of our effort.

2. Negative Comments

The only negative comment that was made was that it was not easy to get online answers in real-time. It is true that Web-based courses have an asynchronous property. The instructor can't make himself available online 24 hour per day, but he can check his email regularly, or set up a schedule to be online for chat time. As I was trying to find the reasons behind this comment, I found that the participant had visited the site at 9.30 pm. Maybe we should place a type of notification, that would set off an alarm whenever an e-student visited the site and notified him that someone was available to answer questions.

3. Suggestions

Participants have suggested two possible areas of further concern. The first was that they would like to allow access only to authorized users. The course was intentionally open to the public. Our goal was not to test security or restrict access. As three participants (out of ten) told me after the survey (off the record), their spouses had visited the Website. A password-protected site would have prevented those unexpected but pleasant visits.

The second concern was the authentication of the identification of the student. Plagiarism is a concern for all Web-based tests. As described previously, participant had

ID's as student 1, 2,... , etc and no further benefit would be derived for the participant. Thus, there was no reason for a participant to take a quiz for someone else. Nevertheless, solutions to this problem are a potential subject for further study.

A point of interest was that all visitors were using Internet Explorer version 5 as browser. Even though the site was constructed to serve any kind of browser, designers should consider the fact that no user preferred a different browser.

V. CONCLUSIONS

A. SUMMARY OF RESEARCH RESULTS

As a result of this research, we saw that statistically there is no difference between the performance of students in the classroom and online. The web-based course matched up well with the traditional course. The use of specific design principles to build the Web course, contributed to eliminating problems related to interface.

We witness comments very supportive of this effort. Hellenic Navy officers indicated that military personnel would welcome the development of distance learning program within the Hellenic Navy. For the development of the site we used commercial of the shelf (CMOS) software that is available at low price or freely distributed.

A point of interest is that we spent more time and put more effort to develop the course online than to teach it in the classroom. Even if the course material was the same, the instructor had to organize it in a different way in order to present it through the Web. The author was instructor of the same course five times in the past in a classroom, but it was the first time he used the Web to reach students, or if you prefer students used it to reach him. The technical assistance of a computer expert was not necessary because the author had a strong background on Web site developing and had completed two courses related to Web publishing. We believe that a Web design team must be available to instructors in order to optimize the course developing time, even for a single course. It would save time and would encourage instructors to use this modern technology for teaching. We realized that the Web site hosting courses could be a virtual meeting point for students to get updated information after completing the course.

As an instructor, the author would use a Web based course in conjunction to a traditional classroom and as a place where former students could keep up with the news. For example, instead of having a course in classroom for three weeks, we could have students taking an online seminar and then have them in classroom for one week only. In that way, active military personnel would not be dispatched from their units for prolonged periods. Or online resources could be presented during the traditional course,

as an indirect way to make students seek information on their free time and at their own initiative.

During this research, we noticed no preference in time, day, or place. Students used the time and the place that was most convenient for them.

B. FUTURE WORK

There are still some issues that need further investigation. For example, should a ship is underway, how can we give the crew the opportunity to take a course online without affecting or compromise operations. Another concern is the authorized access to Web site and the verification of the identity of a student taking a course online. Should students derive benefits from participating in online courses, a credible system of identification has to be established. Also, this research concentrated only in one class and one course, and not for the entire education program of the Navy. In order to implement the distance-learning program for the Hellenic Navy to a wider scale, a project should be initiated in order to manage and optimize the use of both human and hardware resources.

LIST OF REFERENCES

1. Michael Simonson, Sharon Smaldino, Teaching and learning at a distance, Prentice Hall Inc, 2000
2. Cynthia C.Jones Shoemaker, Leadership in continuing and distance education in Higher Education, Allyn and Bacon, 1998
3. Schreiber Berge, Distance training, Jossey-Bass Inc, 1998
4. Jerold W Apps, Problems in continuing education, McGraw-Hill Inc, 1979
5. Rafa Kouki , David Wright, Telelearning via the Internet, Idea Group Publishing, 1999
6. Karen Mantyla, The 2000/2001 ASDT Distance Learning Yearbook, McGraw-Hill Inc, 2000
7. Anil Aggarwal, Web-Based Learning and Teaching Technologies: Opportunities and Challenges, Idea Group Publishing, 2000
8. Erich Stefanyshyn, Design principles for Web based courses, NPS Thesis, Sep 2001
9. David Ryan-Jones, Cheryl Hamel, Guidelines for Evaluation of Internet-Based Instructions, 2000
10. Office of the Under Secretary of Defense for Personnel and Readiness (1999) Department of Defense Strategic Plan for Advanced Distributed Learning, 1999

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California
3. Hellenic Navy General Staff, Department of Personnel-Training
Holargos Athens, Greece

4. Professor Rudolph Darken
Naval Postgraduate School
Monterey, California

5. CDR Chris Eagle
Naval Postgraduate School
Monterey, California

6. Stavritis Georgios
Peyki Athens, Greece

7. D.I.K.A.T.S.A
Inter-University Center for the Recognition of Foreign Academics Titles
Athens, GREECE
